



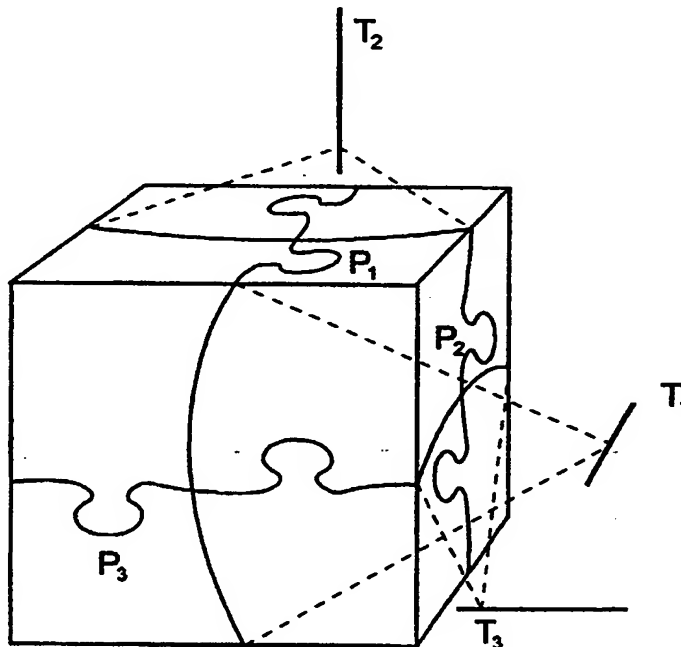
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(21) International Application Number: PCT/FI00/00296 (22) International Filing Date: 7 April 2000 (07.04.00) (30) Priority Data: 990782 9 April 1999 (09.04.99) FI (71)(72) Applicant and Inventor: JÄMSÄ, Sauli, Sakari [FI/FI]; Ylipalontie 9 B, FIN-00670 Helsinki (FI). (74) Agent: BERGGREN OY AB; P.O. Box 16, FIN-00101 Helsinki (FI).	(81) Designated States: AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, CA, CH, CN, CR, CU, CZ, DE, DK, DM, DZ, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TR, TT, TZ, UA, UG, US, UZ, VN, YU, ZA, ZW, ARIPO patent (GH, GM, KE, LS, MW, SD, SL, SZ, TZ, UG, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GW, ML, MR, NE, SN, TD, TG). Published <i>With international search report.</i> <i>In English translation (filed in Finnish).</i>	

(54) Title: THREE-DIMENSIONAL JIGSAW PUZZLE

(57) Abstract

In a three-dimensional jigsaw puzzle which is made up of a plurality of pieces fitting together along mating surfaces facing each other and which, when assembled, forms a continuous piece of a predetermined shape, at least one linking surface between the pieces is a part of a surface which is produced when a line (P_1, P_2, P_3) which is contained in a certain plane in a three-dimensional space and which is a tortuous line, or the like, rotates about a straight line (T_1, T_2, T_3) contained in the same plane, in such a manner that the distance of each of the points in the line from the axis is maintained. The shape of the line being selected to be, for example, folded, in such a manner that the pieces will not be detached from each other in any other direction than by being moved in the said rotational direction.



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Three-dimensional jigsaw puzzle

The invention relates to a three-dimensional jigsaw puzzle which is composed of a plurality of pieces fitting together along mating surfaces facing one another and which, when assembled, forms a continuous piece of a predetermined shape.

There are previously known many three-dimensional jigsaw puzzles. Some of them are combinations of flat jigsaw puzzles, for example, for house walls, and others genuinely three-dimensional, in which pieces are fitted together in several different directions. Constructions of the former type, made up of flat puzzles, are known from, for example, US patent 5 217 226, US patent 5 178 391, GB patent 2 231 808, US patent 3 578 331, and US patent 4 824 112. Jigsaw puzzles of the latter type are known from, for example, GB patent 1 242 942 and GB patent 2 118 845. In the puzzles of the latter group there are two or several so-called directions of cut along which the piece can be thought to have been sawed into two.

The object of the invention is to provide more possibilities for variation and more difficulty than in known options. This is done by fitting the pieces together by sliding a shoulder or shoulders of one piece into a groove or grooves in another piece in such a manner that there is a rotary movement connected with the fitting together, the shoulders being shaped as arcs of a circle. Furthermore, the grooves and the shoulders have mating cross-sectional profiles.

A method such as this for fitting the pieces together provides more possibilities for variation in the shapes of the pieces than do the existing three-dimensional jigsaw puzzles, because even if two pieces have grooves with the same cross-sectional profiles, the radii of curvature of the grooves may be different and in different orientations. In this case the pieces do not fit together with a same third piece.

The jigsaw puzzle according to the invention is characterized in that at least one linking surface between the pieces is part of a surface which is produced when a line which is contained in a certain plane in a three-dimensional space and which is a broken line, tortuous line, or the like, deviating from a straight line, rotates about a straight line included in the same plane, in such a manner that the distance of each of the points in the line from the straight line is maintained, the shape of the line being selected in such a manner that the pieces will not be detached from each other in any other direction than by being moved in the said rotational direction. These linking surfaces contain grooves and shoulders which glide one inside another. Dif-

ferent groove-shoulder pairs may be by their cross-section and their radius of curvature the same or partly the same or all different.

Preferably all the pieces are different in shape, but the puzzle may also have mutually identical pieces, in which case their places can be interchanged. In this case they may have different picture motifs, making them different from one another. The puzzle may also have groups of pieces which are of identical shape in their outer appearance but which, however, are made up of individual pieces of different shapes. In this case entire groups of pieces can be interchanged, in which case the jigsaw puzzle has more than one solution (by solution is meant the linking of all of the pieces together in order to achieve a certain outer appearance). There may also be several solutions without there being any mutually identical piece groups or pieces.

A jigsaw puzzle according to the invention may also have several solutions having different outer appearances, in which case the pieces are linked together in different combinations.

Preferably the attachment surface between the pieces is in shape an otherwise straight plane, but it has a fold having the shape of a circle arc (in one piece a groove, in the other a shoulder) in such a manner that the shoulder cannot be fitted in the groove by pressing but only by sliding from the end of the groove. On the other hand, the attachment surface may be in shape any surface which is produced when a certain line included in a plane of a space is rotated about a straight line included in the same plane (hereinafter "axis of rotation") in such a manner that the distance of each point of the line from the axis remains constant and the shape of the line does not change.

When assembled, a jigsaw puzzle according to the invention is a three-dimensional object, which may be of any shape, for example, a hexagon, a sphere, a cylinder, or something else. The puzzle has at least two pieces, but usually more. In a two-piece puzzle there is only one linking surface, i.e. one groove-shoulder pair. Preferably the axes of rotation of the linking surfaces contained in the puzzle are in different orientations, for example, three orientations perpendicular to one another. They may also be parallel, and even congruent.

Preferably the fabrication material is so hard that the outer appearance of a piece cannot be changed without tools while the puzzle is being solved, but it may also be soft (e.g. foam plastic or cellular plastic).

The advantage of the invention is that the assembler of the jigsaw puzzle has to seek not only cross-sectional profiles which fit together (as in conventional flat jigsaw puzzles) but also grooves and shoulders which have compatible radii of curvature. Furthermore, the puzzle can be constructed to be such that its assembling will succeed only in a specific order.

The invention has the specific advantage that, when two or more pieces are fitted together by means of a curved groove-shoulder pair, the person doing the puzzle cannot always know in which direction he should move the pieces in order to detach them. He will see on the outer surface of a group of pieces only the cross-sectional profile of the groove-shoulder pair. If he knows that the groove is straight, he can conclude from the position of the profiles on the group surface by what kind of a movement the pieces (groups) containing the groove and the shoulder detach from each other, but if the grooves and the shoulders may be curved, the orientation and extent of the curvature, and thus the direction of movement, cannot always be concluded. This makes a puzzle according to the invention more difficult to assemble and disassemble.

The puzzle may be completely of one color, or it may have colors or picture motifs with the help of which pieces fitting together can be sought. It may also be of a transparent material, in which case there may be some object to be assembled inside.

The invention is described below with the help of the accompanying drawings, which do not limit it in any way.

Figure 1 depicts the surface of a jigsaw puzzle piece, which surface is formed when line P is rotated x degrees around straight line T.

Figure 2 shows a piece surface of another shape.

Figure 3 shows a jigsaw puzzle in which all of the axes of rotation (2 axes, since there are two attachment surfaces between 3 pieces) are congruent.

Figure 4 shows a jigsaw puzzle which has two parallel but not congruent axes of rotation.

Figure 5 shows a jigsaw puzzle which has two axes of rotation in different orientations.

Figure 6 shows a jigsaw puzzle having 8 parts.

Figures 7a and 7b present piece pairs of similar outer appearance but which are disassembled with different movements.

5 Figure 1 thus depicts a folded jigsaw puzzle surface, which is formed by rotating a curved line P included in the same plane as a straight line T through angle x around the straight line T.

Figure 2 depicts a surface of a corresponding type, with several folds. What is important is, of course, that at least one fold always bulges in the direction away from the base, so that the pieces will remain attached to one another.

10 Figure 3 shows three jigsaw puzzle parts in which the axes of rotation of two linking surfaces are congruent, i.e. when the pieces are fitted together/disassembled the rotational directions are the same. If, however, the axes of rotation are located on different sides of the combination, as in Figure 4, the rotational directions of the pieces are, of course, different.

15 The puzzle may be made more difficult by using two or more axes of rotation, located in different planes. In the case of Figure 5 there are two axes of rotation T_1 and T_2 , in Figure 6 there are three axes of rotation T_1 , T_2 and T_3 . The axes of rotation may be orthogonal or at arbitrary angles one relative to another.

Finally Figures 7a and 7b depict two cases in which the pair of pieces looks in each case the same, but detaching takes place by rotation in different directions.

Claims

1. A three-dimensional jigsaw puzzle, which is made up of several pieces fitting together along mating surfaces facing one another and which, when assembled, forms a continuous piece of a predetermined shape, characterized in that at least one of the linking surfaces between the pieces is part of a surface which is produced when a line (P) which is contained in a certain plane in a three-dimensional space and which is a broken line, tortuous line, or the like, deviating from a straight line, rotates about a straight line (T) contained in the same plane, in such a manner that the distance of each of the points in the line from the axis is maintained, the shape of the line being selected in such a manner that the pieces will not be detached from each other in any other direction than by being moved in the said rotational direction.
2. A jigsaw puzzle according to Claim 1, characterized in that the shape of each groove fits precisely together with one shoulder.
3. A jigsaw puzzle according to Claim 1, characterized in that the shape of one or some of the grooves fits together with more than one shoulder.
4. A jigsaw puzzle according to Claims 1-3, characterized in that from the coloring or the shape of the surface it is not possible to conclude which pieces belong together.
5. A jigsaw puzzle according to Claims 1-3, characterized in that from the coloring or the shape of the surface it is possible to conclude which pieces belong together.
6. A jigsaw puzzle according to Claims 1-5, characterized in that the desired final result of the assembling is a three-dimensional shape, for example, a hexagon, a sphere or an irregular shape, made up of the entity of the pieces fitted together.
7. A non-transparent jigsaw puzzle according to Claims 1-5, characterized in that the final result of the assembling is an object formed on the inside, visible to the outside through a partially transparent material of the pieces.
8. A jigsaw puzzle according to Claims 1-7, characterized in that it has more than one solution, in which case solution denotes the assembling of all of the pieces in order to attain the desired outer appearance, surface pattern or object forming inside.

9. A jigsaw puzzle according to Claims 1-8, characterized in that inside it there is a labyrinth, a sound device, or the like, which begins to function when the jigsaw puzzle has been assembled correctly.

5 10. A jigsaw puzzle according to Claims 1-9, characterized in that one or several of its pieces has, separate from the other pieces, some independent function, such as a seat, a bottle holder, or the like.

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fig. 1

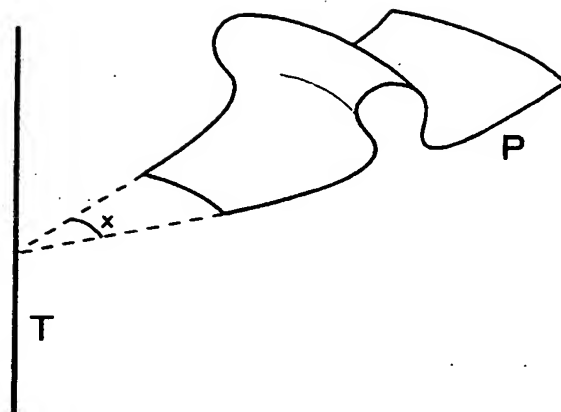
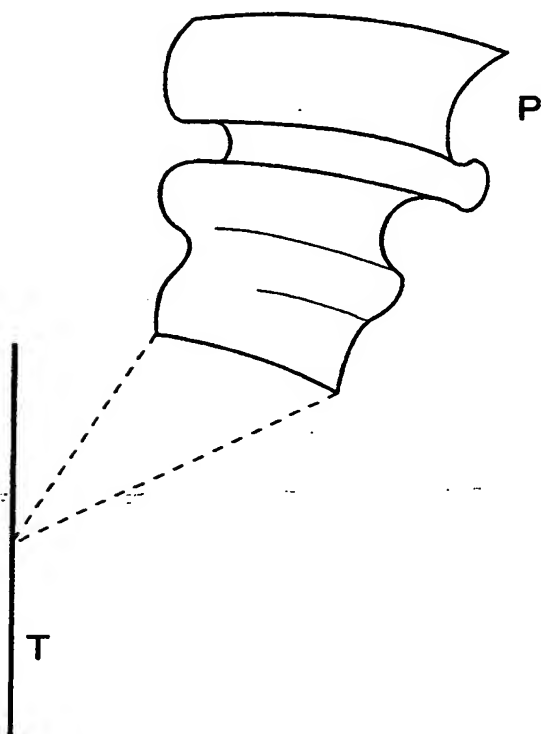


fig. 2



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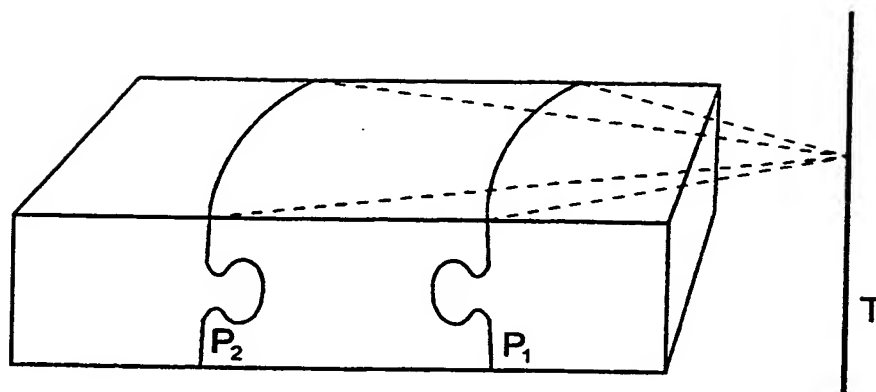
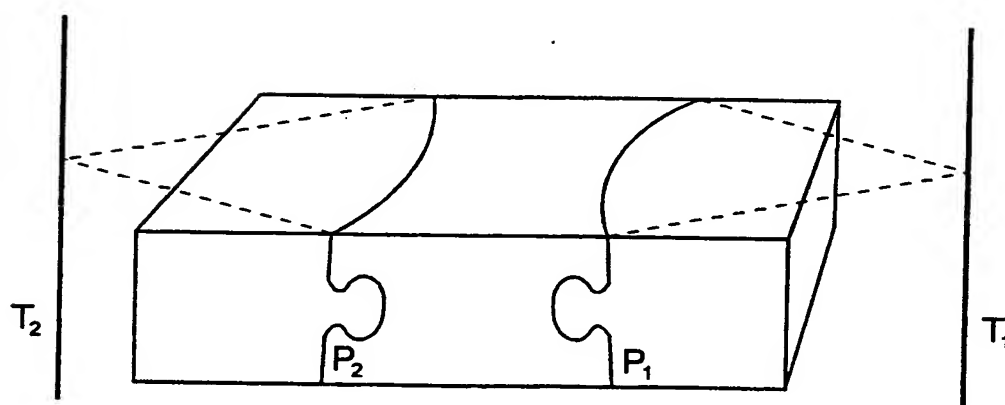
fig. 3fig. 4

fig. 5

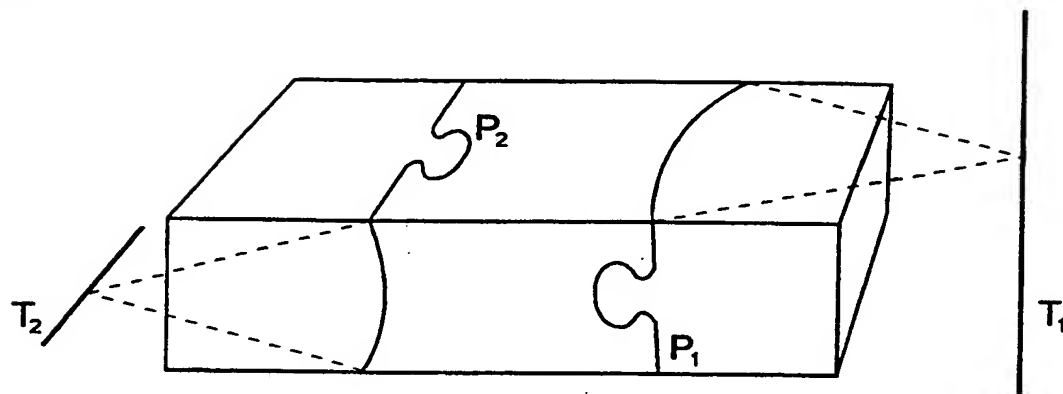


fig. 6

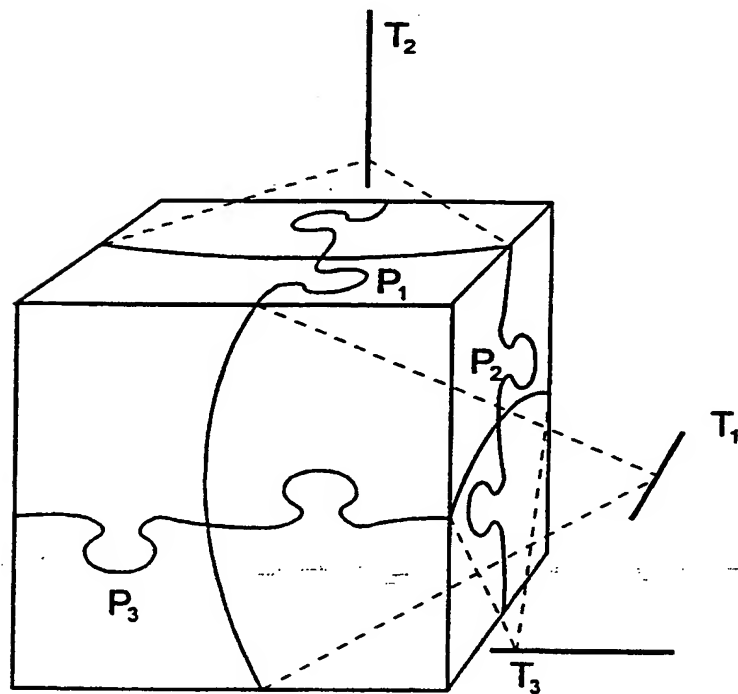
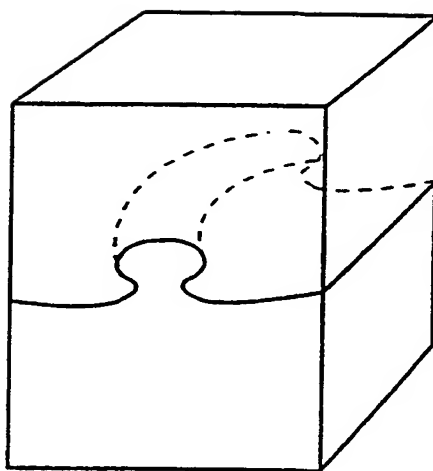
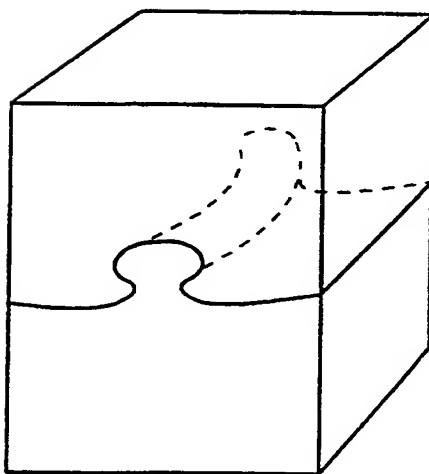


fig. 7

7a



7b



INTERNATIONAL SEARCH REPORT

International application No.

PCT/FI 00/00296

A. CLASSIFICATION OF SUBJECT MATTER

IPC7: A63F 9/12

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

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IPC7: A63F

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

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C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 5826873 A (G. LAVERMICOCCA), 27 October 1998 (27.10.98), figures 5-19, abstract --	1-6
A	US 3981506 A (W.A. DANIEL ET AL), 21 Sept 1976 (21.09.76), figure 8, claim 1, abstract --	1
A	FR 2258208 A1 (BERNADAD, J.C.), 18 August 1975 (18.08.75), figure 1, claim 1 --	1-6
A	US 4874176 A (S. AUERBACH), 17 October 1989 (17.10.89), figure 1, abstract --	1-6

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C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	<p>US 5110528 A (N.C. GREENFIELD ET AL), 5 May 1992 (05.05.92), figure 2, abstract</p> <p style="text-align: center;">-- -----</p>	1-6

INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.
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Patent document cited in search report			Publication date	Patent family member(s)	Publication date
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US	4874176	A	17/10/89	NONE	

US	5110528	A	05/05/92	NONE	

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